

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

Gaseous Cometary Coronal/NAGW-1158

PERFORMING ORGANIZATION

The University of Michigan
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INVESTIGATOR'S NAME

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DESCRIPTION (a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)

a. Strategy: Ground-based observations of coma emission line profiles permit direct insight into the composition and kinetic state of a cometary atmosphere and in turn provide much needed constraints in reconstructing a comet's history; the profiles themselves yield information on the mechanisms generating the observed species, while their intensities correspond to overall production rates by the nucleus. Intensities and line profiles at wavelengths 6562.7A (H-alpha) and 6300.3A ($O(^1D)$ decay) were obtained for Comet Halley in the period March-April 1986 and for Comet Wilson in the period March 1987 using the Fabry-Perot optical facility at Arecibo; the Comet Halley observations have been undergoing careful analysis as the main effort of this project.

b. Accomplishments: Attention has centered on $O(^1D)$ 6300A observations obtained over four consecutive nights in April 1986. Surprisingly, the sorts of profiles to be expected in coma observations have not been theoretically developed in the past, necessitating our reappraisal of this question. It turns out that coma profiles vary noticeably according to excitation mechanism, and the proper interpretation of a profile requires the use of the appropriate model type. A paper cataloging the basic types and their interpretation will be submitted for publication in a few months. The intensities of the 6300A emission can be used independently to estimate the production rate of H_2O by the comet nucleus; indeed, this may be the most reliable way of determining this basic quantity using ground-based facilities. The H_2O production rates implied by our observations throughout the period March-April 1986 have been derived and are to be presented at the upcoming COSPAR special session "Aeronomy of Comets and Outer Planets."

c. Anticipated Accomplishments: Armed with a firmer understanding of how to interpret profiles and the experience gained with the peculiarities of coma observations, new instrumental goals can be defined that will be better suited for future observations (in particular, ground-based support of a CRAF-type mission). We also anticipate sharing data with other groups (notably, Roesler's group at the University of Wisconsin); it is hoped that further insight into the kinetic state of the Halley coma near the time of the spacecraft encounters will be gained when the profiles are analysed using the new interpretational tools. We also anticipate reducing the Comet Wilson data for comparison with the completed analysis of our Comet Halley observations.

d. Publications

Bishop, J., and S.K. Atreya [1988] Cometary line profiles, manuscript in preparation.

Kerr, R.B., C.A. Tepley, R.P. Cageao, S.K. Atreya, T.M. Donahue, and I.M. Cherchneff [1987] Observations of Comet Halley at H-alpha and 6300A. Geophys. Res. Lett. **14**, 53-56.

Kerr, R.B., et al. [1988] Ground-based observations of cometary coma at H-alpha and 6300A: A Review. To be submitted to Adv. Space Res.